Applying Lean to NPI

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Introduction

“Lean” has been applied to a wide variety of manufacturing processes for many years. It began to be defined in the automotive sector, but has since expanded into a wide variety of manufacturing environments. Increasingly the approach and tools are being applied in service industries such as retail, finance and healthcare.

The application of Lean into New Product Introduction (NPI) seems to have been strangely neglected. Can Lean be applied to NPI? After all, it is just a different type of process. This insight document aims to discuss how Lean and its underlying tools can be applied to NPI.

Back to Basics

Although some of the tools and techniques of Lean can be traced back through the decades and even centuries to Adam Smith and beyond, the philosophy was defined in the late 1980s and early 1990s. This was primarily from the experiences of the automotive sector. Since then, the approach has been applied to varying degrees of success in a wide range of transformational processes from manufacturing, pharmaceutical, finance, healthcare and elsewhere.

In comparison, little seems to have been done in applying the approach to the design and development phase of the process as opposed to the delivery. At best various tools, such as Quality Function Deployment (QFD), Design Failure Modes & Effects Analysis (DFMEA), p-diagrams and Design to Target Cost (DTC), have been developed. However, these appear to have been applied without a clear overall strategy. Similar issues were encountered with the early application of Lean when tools such as Kanban, Single Minute Exchange of Dies (SMED), Statistical Process Control (SPC), etc were implemented without a clear understanding of how they fit together. In some cases, what could and could not be achieved by applying the tool was also poorly understood.

So, what is Lean? Many attempts have been made to define Lean. It is useful at this point to refer to the 5 Principles developed by Womack and Jones in their book *Lean Thinking*.

1. Define value;
2. Map value streams;
3. Create flow;
4. Establish pull;
5. Pursue perfection.

Although perhaps not a concise definition, this provides a structure to developing Lean. We will now look at each of these principles in turn.

Define Value

Understanding value is at the heart of Lean. Does there need to be a different definition of value added and non-value added activities in NPI when compared to the production process? A standard definition is that to be value added an activity needs to:

1. Change the fit, form, or function of a manufactured product, or service, or progress a design to meet the customer’s requirements;
2. It must be done right first time;
3. The customer must be willing to pay for it.

However, some activities may progress a design even though, or even because they are not right first time. Examples include prototypes that do not work as anticipated, or simulations that demonstrate areas for further development of the design. An overzealous definition of NVA may discourage the very creativity that is inherent in the design process. Also, activities are completed early in order to save a greater amount of NVA later in the process. An answer may be to more clearly define what is of value to internal as well as external customers.

With care and thought, each of the seven wastes of Transport, Inventory, Motion, Waiting, Overproduction, Over-processing and Defects can be applied to NPI. In manufacturing various other wastes have been suggested including Talent and...
Energy. An 8th waste in NPI could be wasted Knowledge. It could be used to capture issues where the design is not right first time and the information gained from this is not identified, or used appropriately.

**Map Value Streams**

A difficulty with the early application of Lean in manufacturing was the effective identification and analysis of the value streams. Rother and Shook came to the rescue with the publication of *Learning to See*. However, it is still a challenge to apply the tool in NPI.

When developing a Value Stream Map (VSM) of a NPI process there is often confusion between material and information flow as the material is not always in a physical form. The addition of “Knowledge Flow” to the three flows of Material, Information and Time defined in *Learning to See* can help to resolve this confusion. It can also help with mapping the flip flop between knowledge and material flows in prototyping and simulation activities.

**Create Flow**

Many companies have attempted to define their NPI activities through a gated process. However, even then NPI can be a catalogue of delays and problems as effort is spent to negotiate the blocks and bottlenecks along the way. Too frequently this results in new products failing to meet the customer requirements, being late to market, exceeding their target costs, overspend on the project budget, or a combination of these problems.

Where a company does not have a defined and documented gated process, the first step in creating flow is to define and document the gated process. Other tools and techniques that have been tried and tested in the production process can then be, with a little imagination, applied to NPI.

In Lean, a key method of reducing the variability in a process and improving flow is the application of standard work. NPI is often defined as a variable even random process reliant on inspiration to succeed. However, when it is broken down into its constituent steps it becomes “90% perspiration and 10% inspiration”. How many new products are completely new and how many are developments of existing designs? If modular designs and effective product data management are developed, the process can become even more predictable.

The use of multi-disciplined, co-located teams, eg skunkworks, is highly effective at unblocking the flow of NPI. Teams involved in developing sub-systems can be grouped in clusters around a central location used for system integration. This can present challenges to large programs and where teams are spread around the world.

Set-based concurrent, or simultaneous engineering can be applied to reduce changeover and handover losses as well as ensuring the impact of decisions on other parts of the design are considered early in the design process. The key to these techniques is effective team work and the management of knowledge.

A major issue with creating flow in NPI is the tendency to launch development projects without any consideration of the availability of sufficient resources. Projects launched are often under resourced at the crucial early phases of the project when critical decisions are made sometimes by the least experienced people, or by people with little time available to fully consider the decision. As a consequence, problems are stored up and need to be solved by the most experienced people when time pressures are at their greatest. This creates a viscous cycle that is difficult to break.

If models are developed to estimate the resources required on projects, a view of load and capacity can be taken. Decisions can then be taken to adjust the timing of projects in order to level schedules, or at least efforts made to flex resources to meet the demand. Take time can be calculated and used to aid the management of resources, monitor flow and highlight bottlenecks.

**Establish Pull**

In NPI, projects can be launched almost on the basis of infinite capacity. This leads to waste as insufficient time is allocated to do activities properly due to the volume of work that is expected to be completed. If pull is introduced, projects won’t be launched until capacity is available and there is demand from the customer.

A tool that is synonymous with Lean is Kanban. Indeed, it is often mistaken for Lean! Nevertheless, it is highly effective at managing flow by preventing production without demand from the customer, or to stop upstream production when there is an interruption to flow downstream.
Can Kanban be applied to pull NPI through the process? In manufacturing, Kanban is used to provide signals between the areas of continuous flow. Co-located development teams can be considered as areas of continuous flow in NPI. However, where there is still a functional element to the organisation of NPI, Kanban can be used to indicate demand from downstream. Upstream areas can then begin the next scheduled project in order to meet that demand.

The use of kamishibai boards can also be used to make the workflow more visible. They can either be used to illustrate the volume and flow of work through the process, or T-cards used to highlight individual tasks and workload.

**Pursue Perfection**

As with any process, structured problem solving, eg PDCA, DMAIC, 8D, etc. can be used in NPI to drive continuous improvement especially if it is perceived to be any other process. However, it is extremely difficult to complete problem solving effectively without KPIs to measure the process.

Development project budgets are usually tracked, but other measures of NPI are often missing. How closely the product is to its target unit cost is often measured at the end of the project, but may not be tracked through the project.

Useful measures that could be introduced include lead time through the different stages of the development process. The amount of work backlog could also be measured. As with Work in Progress (WIP), this Design in Process (DIP) could be used to identify bottlenecks and target improvement activities.

In Lean manufacturing Overall Equipment Effectiveness (OEE) is used as a key metric. Can OEE be used in NPI? How about Overall Engineer Effectiveness? Availability, performance and quality losses could then be used to identify opportunities for improvement.

**Conclusions**

In reality, Lean has been applied to NPI for many years. Specific tools for the elimination of waste in NPI have been developed including QFD, FMEA, DTC, Design for Manufacture/Assembly (DFM/A), etc. However, much as with the early application of lean in manufacturing, the underlying principles and reasons for the use of these tools is often overlooked, eg Kanban does not reduce inventory, it manages it. As a result, the effectiveness of the tools is diluted, or lost completely.

In order to gain real benefit from Lean in NPI, it must be applied strategically as well as tactically and in its entirety rather than cherry picked.